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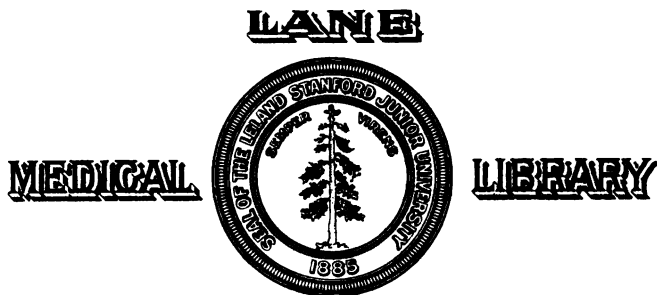
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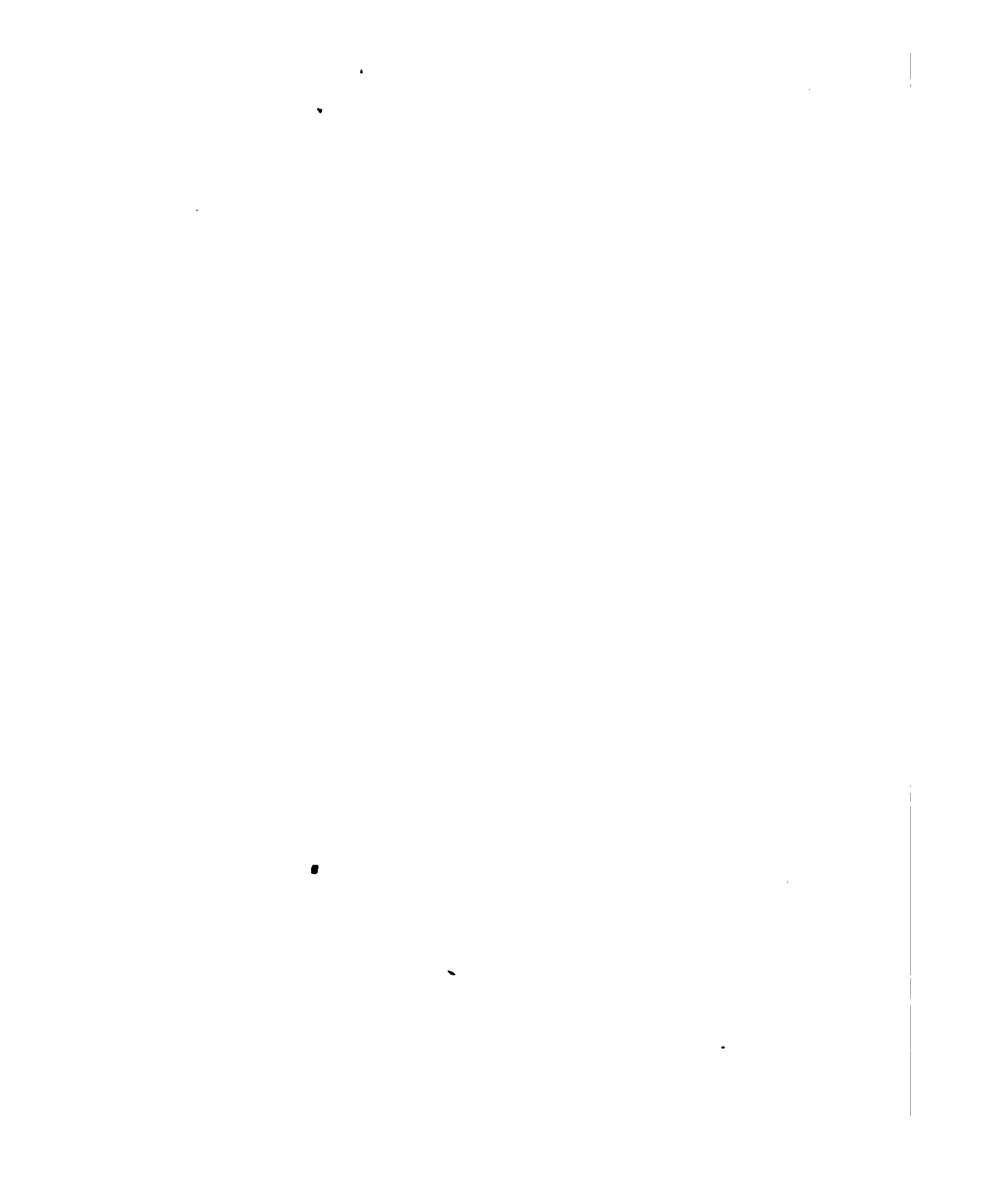
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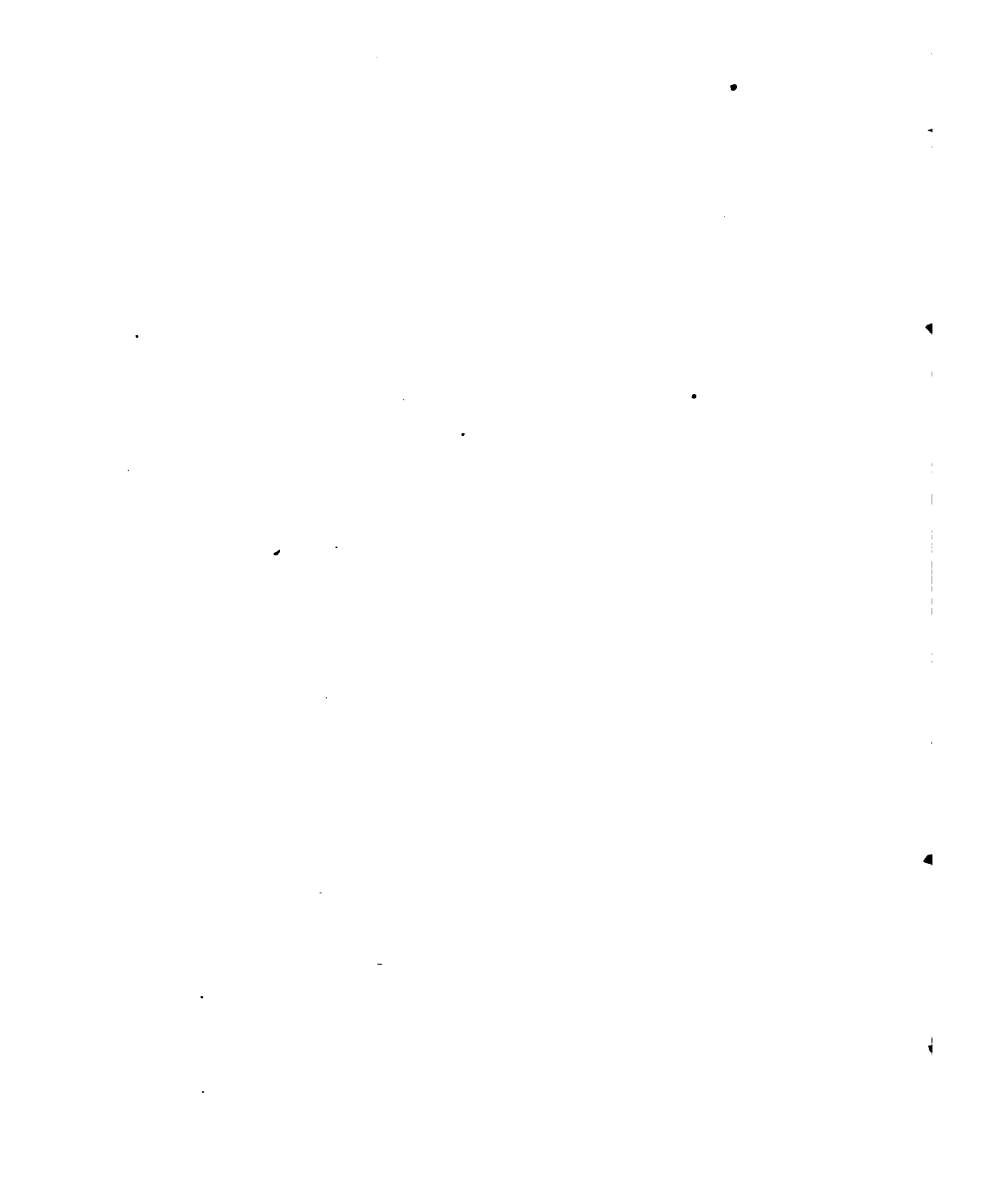
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BATHS AND BATHING.

CHAPTER I.

THE PHYSIOLOGICAL ACTION OF BATHS.

SINCE the influence of baths is exerted primarily upon the skin, and through the medium of the skin, upon the deeper-lying tissues and organs of the body, it is an absolute necessity for the reader at the outset to be made aware of the structure of the skin and its functions, as well as the relations which it bears to deeper-lying organs.

If the skin, say of the thumb, be looked at with a lens of moderate power, its surface is seen to be arranged in ridges and furrows, like a ploughed field ; and at frequent intervals along the ridges are little depressions, which are known as the pores of the skin. These pores are the openings of the sweat ducts, and it is through these pores that the perspiration exudes. They are exceedingly numerous, and it has been calculated that there are as many as 2,800 to every square inch of surface, or about seven millions of them altogether. The ridges are seen to be divided into a series of minute hillocks,

or *papillæ*, which are arranged in lines. These *papillæ* are the organs of touch, and are probably as numerous as the pores. They contain in their interior either loops of blood-vessels or nerve-endings.

These nerve-endings in the *papillæ* are of three kinds, which are readily distinguishable, and are known as tactile corpuscles, pacinian bodies, or end bulbs, according to the form which they take. Between the superficial and deep layers of the skin, the so-called cuticle and cutis, is a layer which partakes somewhat of the character of both. This is called the *rete mucosum*, and it is here that the pigment, found in the skin of the negro and in certain parts of the skin of white races also, is located.

Beneath the skin, in the subcutaneous tissue, are situated the sweat-glands, which are microscopical bundles of tubing, having one end running through the skin to terminate in the pores. These tubes are, or rather would be, if straightened out, about a quarter of an inch long; and it is estimated that the length of them in the entire body is about 28 miles! They pass through the upper layer of the skin or cuticle spirally, so that, although it is an easy matter for fluid to pass *out*, the passage in the opposite direction is by no means so easy. Each sweat-gland is plentifully supplied with blood-vessels, and is surrounded by a thin muscular coat, which is presumably able to ~~move~~ by its contraction, a certain amount of

pressure, and so drive the secretions of the gland onward towards the pore, or external aperture.

The hair follicles, like the sweat-glands, are situated in the subcutaneous tissue. They are hollow receptacles, from the bottom of which the hairs grow. Alongside of each of these hair follicles is a pair of glands, called the sebaceous glands, which provide that small quantity of natural grease with which our hair is supplied. These glands resemble little bunches of grapes. The hair follicles are also furnished with a couple of small muscles, which, by their contraction, can cause a sensible erection of the hair. In certain parts of the skin there are glands which furnish a special odorous secretion. These are most plentiful in the arm-pits and between the toes. In the skin itself, and immediately beneath it, is a network of "lymphatic" vessels, whose function, it would seem, is mainly to drain the tissue of waste products. These vessels run towards the "lymphatic glands," which, when enlarged, are often recognisable at the side of the neck, and which are very generally distributed throughout the body. In certain parts of the skin are special cells containing pigment.

Thus we see that the skin, which to the casual observer is an almost structureless membrane, is in reality a most complex and elaborate organ, richly supplied with blood-vessels, lymphatic vessels, and nerves, having its millions

of papillæ and pores, and its miles of sweat-ducts. The hair follicles, with their sebaceous glands and muscles, are also to be reckoned by the million, and its odoriferous glands and special pigment-bearing cells probably by the thousand.

What are the various uses of this elaborate organ? In the first place, it serves as a protection to the softer parts beneath. Secondly, it serves to regulate the temperature of the body, by preventing, on the one hand, the too rapid radiation of the natural heat, and, on the other, by providing a very large surface for the evaporation of the constantly exuding perspiration, it prevents the overheating of the body. Thirdly, it is constantly removing from the body certain effete materials. These are the scales of the cuticle (which we remove whenever we wash and rub the surface), the perspiration, and the sebaceous, or greasy secretion. The amount of sweat varies immensely; it may be almost nil, or as much as a pint in an hour. The secretion of sweat is influenced by the temperature of the air, by exercise, by the drinking of fluids (especially warm fluids), and notably by the emotions. There can be no doubt that the secretion of a certain amount of sweat is necessary for perfect health; and it is the common experience of all that the checking of perspiration is very liable to be followed by dangerous internal congestion.

It has been demonstrated on some of the lower animals that, if the skin be shaved and varnished, death speedily ensues. This has been spoken of as a sort of cutaneous suffocation, death taking place owing to the charging of the blood with matter which should have been removed by the skin. It has been asserted, however, that death is due to cold in these cases ; and it has certainly been demonstrated that animals so treated live much longer provided they be kept warm by a layer of cotton wool. Sometimes the skin is superficially destroyed by accidental burning or scalding, and it is well recognised that a burn or scald is dangerous to life in proportion to its superficial extent, rather than to its depth or severity.

The blood-vessels of the skin vary much in size under different circumstances, and the different degrees of pallor or redness of the skin are due to the condition of these superficial blood-vessels. The phenomenon of blushing is well known ; and this should serve to remind us that the emotions can not only influence the amount of perspiration, but the size of the cutaneous blood-vessels. The intimate relations existing between the skin and the great nerve-centres should never be lost sight of.

The cutaneous blood-vessels enlarge in certain fevers, as scarlet-fever and measles ; they can be made to enlarge also by the application of warmth, or irritants, such as mustard, or the stroke of a whip. Contraction of the

blood-vessels is most marked in conditions of fear, or as the result of the prolonged application of cold.

Not only have the nerve-centres a great influence on the skin, but the skin is capable of exerting a great influence on the nerve-centres. This is not to be wondered at, when we bear in mind the myriads of nerve-bearing papillæ with which the skin is beset. When the soles of the feet are tickled, the legs are involuntarily moved; and when the arm-pits and sides of the chest are tickled, loud laughter is the result. These two phenomena are examples of what is known as *reflex action*, i.e., the tickling produces an effect upon the nerve-endings in the skin, and this effect travelling to the nerve-centres (the spinal cord or brain) is *reflected* to the muscles, and produces movement of the leg or laughter. When the body is suddenly immersed in cold water, a not uncommon result is a shivering and a chattering of the teeth; and when cold water is sprinkled on the forehead or chest, deep inspiration and a catching of the breath is produced. These are examples of "reflex movements," due to impressions made upon the nerves of the skin; and since many of the results of bathing are undoubtedly due to this kind of reflex action, it is very important to bear it constantly in mind. The connection between the nervous centres (the brain and spinal marrow) and the skin is shown also in the occurrence of what is

known as goose skin, or *cutis anserina*, which is caused not only by the application of cold to the surface of the body, but even more readily by the mental states which make the "Hair of our flesh stand up." The rationale of this phenomenon is the contraction and shortening of the little muscles which we have seen to be in intimate relationship with the hair follicles. There can be no doubt also that the pigment cells, which are scattered thinly throughout our skins, are subject to the control of the nervous centres, and it is well known that the tint of the complexion will sometimes vary with emotional states, as it certainly does with physical states. These considerations are sufficient to show that the skin plays a most important part in the animal economy, as a protective, a secreting, a vascular, and a nervous organ.

An all-important point to be determined with regard to the skin is its power of *absorption*—that is, its power, if any, of allowing substances to pass through it, and so reach the interior of the body. It is well ascertained that, if the surface of the skin be broken, absorption takes place with great rapidity, and that even when the skin is not broken, it is comparatively easy to get absorption of certain matters, such as mercurial ointment or extract of belladonna, provided they be applied with a certain amount of friction. We saw that the ducts of the sweat-glands perforated the skin spirally, and the

friction has the effect of opening the mouths of these little ducts, so that the greasy or sticky preparation gets lodged within them and absorbed.

It has been proved with tolerable certainty that gases, such as carbonic acid and oxygen, are capable of penetrating and permeating the skin in small quantities, but it is extremely doubtful if water is ever absorbed through the skin. It has been attempted to settle the question by weighing the body before and after a prolonged immersion in the water, but such experiments are so beset with fallacies that they are almost worthless. The fact that shipwrecked sailors are in the habit of successfully lessening their thirst by immersion of the body in water, or by wetting their clothes, is well known, but this effect may be due to the arrest of the cutaneous evaporation, or by an effect upon the nerves.

At all events it seems safest, in the present state of our knowledge, to assume that water is not absorbed through the skin ; or if it be, that it is absorbed in such extremely small quantities that the effect of baths can in no sense be due to the absorption of the water in which the body is immersed. As to the absorption of the various salts contained in sea-water or mineral waters, there is no evidence whatever that these are ever absorbed even in the most minute quantities. If the salt dissolved in sea-water were absorbed through the skin, it is tolerably certain

that sea-bathing, far from being the luxury which it is, would be regarded as a highly dangerous and most unpleasant practice.

Baths of all kinds serve, or may be made to serve, as vehicles for temperature, and by their aid we are enabled to surround the body with a temperature which is different to its own. Before we can fully understand the effect of hot and cold baths on the economy, it is necessary to enter into some discussion of the nature and source of the natural heat, of the body. The natural heat of the human body is between 98° and 99° of Fahrenheit's scale; and this temperature, roughly speaking, is uniformly maintained by the healthy body under all the varying circumstances to which it may be subjected. In the arctic regions, and in the tropics the temperature of the body rests at 98.6° ; or, if variations occur, they are so slight in amount as to be hardly noticeable. In a cold atmosphere, therefore, the body has the power of maintaining its heat; and in a warm atmosphere it is equally able to maintain its coolness. This is a remarkable fact, and is due to the power possessed by the human body of adjusting the production and loss of heat. Heat is produced in the body by the combustion of food and tissues, exactly as heat is produced in a fireplace by the combustion of coal. The amount and rapidity of this combustion necessarily varies with the amount and

nature of the food consumed and the activity of exercise and other vital processes. The most active tissue in the body is the blood ; through its agency most of the combustion processes are carried on, and by its rapid circulation to all parts of the body the most distant points of the human frame are kept at the same temperature. The temperature of the blood is due to the amount of combustion taking place in the tissues, and the amount of combustion taking place in the tissues is due to the amount and energy of their blood supply, which last depends upon the force of the heart's action and the size of the blood-vessels which have the power of contracting and dilating, and which are subordinated to the regulating influence of the nerve-centres. If that part of the nerve-centres (the upper part of the spinal cord) which controls the size of the vessels be injured or destroyed, the combustion processes going on in the body seem to get beyond control and the temperature may be dangerously increased or decreased, the exact reason of one or the other phenomenon not being known. The limits of body temperature which are compatible with life are not very wide ; for if the temperature rise to 109° or sink to 76° death will inevitably result, and a rise or fall of 7° from the natural temperature is decidedly dangerous. Seeing how narrow are the limits of temperature within which life is possible, we cannot but be

amazed at the marvellous arrangements for maintaining the normal level of animal heat. The body is cooled by the evaporation going on from the lungs ; by the more important evaporation going on from the skin (every one who has covered a portion of the skin with spirit and has encouraged its evaporation by blowing upon it knows practically the cooling effect of evaporation), and by the radiation of heat from the surface of the body, and the conduction of heat from the body by things in contact with it.

The *immediate* effect of a cold bath is to chill the *surface* of the body, the temperature of which, as tested by a thermometer, may fall several degrees. At the same time there is produced a pallor of the surface and goose-skin. While the surface is cooled, however, the blood itself undergoes an increase of temperature, due to an increase of the combustion processes going on in the body, of which we get additional evidence in the increase of the rate of the pulse and respiration, and an augmented discharge of carbonic acid from the lungs. There is a sudden sense of chilliness, and this impression, made upon the nerves of the skin, produces, by its action on the brain and spinal cord, some slight mental excitement and shivering of the limbs. After the bath has been continued some little time the temperature of the blood falls (sometimes as much as three or four degrees), the pulse and

respiration get slow, the shivering gives place to lassitude, and the mental excitement to listlessness. On removal from the bath the phenomenon of "reaction" sets in. The vessels of the skin enlarge, the chilliness gives place to warmth; and the feeling of uneasiness is succeeded by a sense of comfort. This reaction follows most quickly when the bath is of short duration, and when its effects are suddenly induced. The shorter the bath the less is the ultimate depression of the temperature of the blood. The shorter the bath the greater is its power of *stimulating* function; the longer it is continued the greater is the effect of *cooling*.

The effect of a *warm* bath is to raise slightly the temperature of the surface and the temperature of the blood. The pulse and respiration are both quickened, and the escape of carbonic acid from the lungs is also increased. The blood-vessels of the skin get dilated, and the surface is reddened in proportion to the heat of the water. Warm baths of a moderate temperature can be borne for a longer time than cold baths; but if the temperature be too high, and the bath too long-continued, faintness is liable to occur. On removal from the hot bath the skin is in a very delicate and susceptible state, and the vessels are liable to "re-act" in the direction of extreme contraction, in which case dangerous internal congestion may occur. If, however, the skin be protected, and the patient

be placed in a warm room, or in bed, a violent perspiration will ensue. In the cold bath the muscles are liable to become stiff; but in the warm bath a stiff and fatigued muscle will resume its suppleness. After a hard day's hunting a warm bath is a well-known and agreeable luxury.

The phenomenon which is popularly known as "reaction," and which occurs after both hot and cold baths, is a most remarkable one, and seems to show that our bodies resent any interference with their function. Thus experiments have shown that if the temperature of a healthy man be raised or depressed by any artificial means, such as hot or cold baths, the subsequent reaction in the direction of the depression or exaltation of the temperature is such that the mean temperature of health is accurately maintained. A German observer, Jurgensen, found by a series of accurate observations on a patient who submitted to a series of baths of a temperature of 50° Fahr., each bath lasting twenty-five minutes, that notwithstanding the rapid abstraction of heat, which gave rise to shivering, lasting for several hours, the diminution of bodily temperature which occurred during the bath was followed, after an interval of four or five hours, by an elevation which precisely compensated it, so that the mean normal temperature was maintained in spite of the interference of the physiologist.

It will have been observed that the ultimate result of

both hot and cold bathing, if conducted in moderation, is about the same, viz., an increased circulation of blood through the skin. In both cases also, the combustion going on within the body is increased, as evidenced by the escape of an increased quantity of carbonic acid from the lungs. In the case of the cold bath, this increased combustion is due to the stimulating effect of the cold water, while in the hot bath it is due to the artificial heat facilitating the natural combustion processes of the body. The effects of the hot and cold bath upon the combustion processes going on in the body may, not inaptly, be compared to the effect produced upon a furnace by the hot and cold blast, both of which encourage combustion and increase the heat given off by the furnace; but the hot blast so facilitates combustion that the same work is done by its aid, with an expenditure of $2\frac{1}{2}$ tons of coal, that is done by the cold blast with an expenditure of 8 tons of coal. If we want a fire to burn well, we have several courses open to us; the first is to poke it, which may be regarded as simple stimulation; the second is to supply it with a cold blast, in which case we supply large quantities of oxygen, but at the same time counteract the heating effect by the coldness of the blast. By employing a hot blast, the combustion is facilitated without any counteracting chilling. By each of these methods we hasten the ultimate extinguishing of the

fire, unless fresh fuel be added. The employment of the hot blast entails the most economical use of the fuel.

It has been said, with regard to the use of baths, that *cold stimulates, but heat facilitates function*. "Between the two therapeutic opposites," says Braun, "a similar relation exists, as between winter and summer life, and between sea and mountain air. The physician who has, to a certain extent, acquired an insight into the diseased side of mankind, divides the chronically sick into two groups, the one consisting of individuals whose organism has sufficient capital to afford the strong reaction required, the other consisting of persons needing nice management, and whose own power cannot be exposed to any great demand. For the one there is the system of exercise, cold treatment, cold baths, sea baths, and sea air; for the second, indulgence, warm treatment, warm climate, warm baths, mountain air."

Seeing that both hot and cold baths increase the natural combustion of the body, it will be evident that persons undergoing a course of treatment by either method should be exceedingly careful that during the progress of their course of treatment the best fuel only is placed on the human furnace. They should eat the simplest and most nutritious food, and breathe nothing but the purest air.

CHAPTER II.

THE VARIETIES OF BATHS.

THE *tepid* bath has a temperature of from 85° to 92° Fahr., the *warm* bath a temperature between 92° and 98° Fahr., and the *hot* bath a temperature of from 98° to 112° Fahr.

The *cool* bath has a temperature from 60° to 75° Fahr., and the *cold* bath is of a temperature below 60° Fahr., downwards to the freezing point of water.

Hot or cold water may be used locally. We are familiar with the hip-bath and foot-bath, and occasionally we meet with baths of a special shape, made for the reception of the arms or hands, in cases where their local treatment has been deemed necessary.

Various plans have been devised for increasing the stimulating effect of water. One method of attaining this object is by keeping the water constantly in motion, as is done in the so-called *wave bath*, common in some parts of the Continent. Another way is by so increasing the size of the bath that the patient is able to move freely in it. In a big bath, not only is the good effect of exercise able to be added to that of bathing, but the concussion of the water on the surface of the body, and the constant change of the stratum of water in contact

with the body vastly increases the power of the bath in influencing the temperature and stimulating the skin.

The best of all baths is the *swimming bath*, for in it the bather can indulge in a free exercise of his limbs, such as is hardly attainable under any other circumstances. Swimming is a very valuable exercise, because it employs the arms equally with the legs, and leads to a healthy development of the muscles of the chest. Nearly all good swimmers are big chested.

The *douche* is a name given to a stream of water, either hot or cold, which is made to fall heavily or with force upon a part. It acts partly by the force of mechanical impact, and partly by its temperature. It is a very exhausting method of treatment, and must on no account be used too long. A column of water 12 feet high, allowed to fall upon the head, is so painful that Esquirol, who submitted to it, described it as resembling the continued breaking of a column of ice on the head, followed by a feeling of stupefaction, which lasted an hour afterwards. The *douche* was formerly much used in lunatic asylums, and was regarded as a specific against delusions, the unhappy creature possessed by delusive ideas being held beneath the *douche* until he recanted ; and such was the agony thus caused, that the mere threat of the *douche* was often sufficient to control the wildest of maniacs. Those who have undergone the process of "shampooing

the head," as practised by the hair-dressers of our time, will remember the effect of a stream of cold water allowed to flow upon the head for too long a time.

The most powerfully stimulating action is obtained by the use of the *Scottish Douche*, which consists in the alternate use of streams of cold and hot water. By the hot stream the "reaction" after the cold stream is greatly encouraged. In most of the swimming baths to be found on the Continent, a pump is provided, in order that a patient may himself apply the douche to any joint requiring it, and at the same time encourage his reactive glow, by the exercise of pumping.

In most great bathing establishments two douches at least are provided, one called the *descending douche*, which may be applied to the head, shoulders, trunk, or limbs; and the other called the *ascending douche*, which is designed for throwing a stream of water into the bowel, a method of treatment which is advocated for conditions which it is unnecessary to discuss in this place.

Hot and cold affusion are merely mild forms of the douche.

The *shower bath* differs from the douche only in the division of the stream of water by causing it to flow through a suitable colander. This method of treatment is severe and exhausting, and must be used with caution, especially with weakly people.

The *needle bath* is merely a general shower bath. The bather stands within a coil of pipes which are finely perforated, and the water impinges in finely divided streams simultaneously upon every part of the body. It is a powerful general stimulant.

The *rain bath* consists in the letting fall of large drops of water from a great height upon the part which it is wished to affect.

Packing with the wet sheet is a mode of applying water to the body which is the very reverse of some of the methods which we have been considering, since the stimulating action of the water is reduced to a minimum, and we get the refrigerating action only. It makes very little difference whether the sheet used be moistened with hot or cold water, since the temperature of the skin and the sheet very rapidly approximate in any case, and the more rapid evaporation of the hot water speedily induces a degree of cold quite equal to that of the cold sheet. The patient should be stripped naked and should lie upon a single blanket, the bed being protected by a mackintosh sheet placed between the blanket and the mattress. He is then enveloped in the wet sheet. If a maximum amount of refrigeration is desired he is left uncovered so that evaporation may be encouraged. If, on the other hand, we wish to encourage the action of the skin, several blankets are placed over the sheet.

Having discussed the various methods of using water as such for the purposes of bathing, we may next turn our attention to the *vapour bath*, which is a favourite method of making use of warmth and moisture. Here and there throughout the world there are to be found natural vapour baths; but, as generally employed, the vapour bath is a very simple contrivance indeed, merely consisting of an apparatus for conducting the steam of a kettle into a confined space in which the patient sits. The head of the patient may be either placed in the bath or not, and the effects of the bath may be expected to differ according as the steam is inhaled into the lungs or not. The domestic vapour bath may consist of a flannel steam-proof cloak, which is worn by the patient, while beneath the chair on which he sits is placed a small portable kettle heated by spirits of wine for the formation of the steam. If the bather is unable to sit up, the steam may, with very great ease, be conducted beneath the blankets of a bed. The vapour bath can be borne much hotter than the water bath, the temperature varying between 120° Fahr. and 150° Fahr. The loading of the atmosphere with vapour, checks, or rather prevents, the natural evaporation of the perspiration, so that while the body is very strongly heated by the steam, the natural methods of cooling the body are arrested. From this it will be that the power of the vapour bath to raise the

body heat is very considerable, and indeed the temperature of the blood has been known to rise as much as 5° Fahr. during a bath. This power of raising the temperature of the body causes a very profuse perspiration, so that the vapour bath is recognised as one of the quickest and most effectual means of producing a copious action of the skin. The vapour bath can be locally applied in a very manageable way, and there is no difficulty in contriving an apparatus, by means of which the legs alone, or one arm, or one leg, may be subjected to the action of the vapour. If a quick reaction is desired a cold douche may be added to the steam, and the so-called *Russian vapour bath* consists of a vapour bath of high temperature followed by a cold douche.

Air baths are baths from which we never escape except when we are taking a water bath, our bodies naturally being always surrounded by a layer of the atmosphere. *Cold-air baths* are not much employed, although they have been recommended; and we have heard of persons who have sought to stimulate their skins and circulation by running naked in the open air. The *hot-air bath* has always, at least since the days of ancient Rome, been a favourite luxury and means of treating disease; these baths, which are also called Russian or Turkish baths, consist really in a succession of processes, which, in the best establishments, are as follows: The bath is received

at a barrier, where he is relieved of his boots and provided with check napkins in which to swathe himself while bathing. Passing the barrier he arrives at the tepidarium, a room of Eastern design, which attracts him by its coolness, quietness, and cleanliness. A marble basin, filled with water, into which a jet of water from a fountain falls with a soothing splash, occupies the centre, while all round are divans for reclining and conveniences for dressing and undressing. Through a Moorish arch at the end a glimpse is caught of the sudatorium, separated by a plate-glass partition from the tepidarium. Stripping himself naked and donning his checks, the bather passes into the sudatorium, an apartment with a domed roof, and having a marble floor and red-brick walls. The temperature of this room is about 120° or 150°, and here the bather sits, reading or otherwise amusing himself until perspiration is fully advanced. If perspiration is not free it may be encouraged by a draught of cool water, which will be tendered him by an attendant. If perspiration is slow in its advance, the heat of the room causes discomfort. Some burning of the skin, quickness of the heart's action, and occasionally a throbbing tensive headache. A drink of water generally has the effect of causing the whole surface to bead with moisture, and then a sense of comfort succeeds to discomfort. Perspiration being fairly started it may be still

further encouraged by removing into a still hotter apartment (of which there are three) varying in temperature from about 150° Fahr. to 210° Fahr. In these hot rooms (where it is necessary to wear thick list slippers to prevent the feet being scorched by the hot marble) the perspiration, in some persons, streams off the body, and when sufficient perspiratory action has been allowed, the bather returns to the body of the sudatorium, and, reclining on a marble slab, he is shampooed by an attendant. Next the whole surface is thoroughly washed with hot soap and water and the skin rubbed with a horse-hair glove; lastly, the process is finished by the application of cold water, which is done in one of two ways, either by the application of the cold douche, or by diving beneath the glass screen which separates the sudatorium from the tepidarium into the marble basin which fills the centre of the latter apartment. This done the bather is rubbed dry, and then indulges for half an hour in the *dolce far niente*, while he reclines on a divan, reads the paper, sips a cup of coffee and smokes a cigarette. As to the value of the Turkish bath we will speak hereafter, and we will content ourselves in this place by warning the bather not to "overdo" it. He should be guided by his sensations, and should not be tempted to go into this room or that room, or submit to this or that process merely because a friend

does so with benefit, or without harm. He must remember that constitutions differ, and if the bath is followed by headache, or a feeling of faintness or lassitude or a want of appetite, he should take this as a warning that the treatment has been too heroic. The strongest Turkish bath is that in which the bather spends his time in the hottest room and finishes with the douche (a process which few can stand); the milder bath is that in which the highest temperature submitted to is about 140° , and the dive into the basin is taken in lieu of the douche. Those who take a Turkish bath for the first time should limit themselves to its milder form.

Mineral Baths are baths composed of water in which a considerable quantity of mineral matter has been dissolved, either by natural or artificial processes. It must be remembered that ordinary water is very far from pure, and that even rain-water, the purest of all natural waters, contains a considerable number of saline ingredients dissolved in it. Spring-water or river-water is very largely impregnated with matter which it has dissolved. The water of London contains from 18 to 20 grains of chalk in solution in each gallon, besides other ingredients. The chief of all "mineral waters" is sea-water, and it is necessary that we should examine its composition somewhat closely. The specific gravity of sea-water is 1027,

and the quantity of salt dissolved in it ranges from 3·5 to 4 per cent., being least in the Black Sea and the Baltic, and most in the Mediterranean. The following is the composition of the water of the English Channel :—

Water	963·8
Chloride of sodium (common salt)	28·0
Chloride of potassium	0·8
Chloride of magnesium	4·0
Sulphate of magnesia (Epsom salt)	2·0
Sulphate of lime	1·4
Bromide of magnesia	} Traces.
Carbonate of lime	
Iodines	
Ammonia	
Oxide of iron	

1,000·0

Sea-bathing is a very popular form of the natural bath, and it is preferable to bathing in river-water or spring-water, because the sea is seldom so cold as are the latter. A sea-bath has also another great advantage over all other forms of bath, and that is that it is taken in the purest air possible; and in considering the effects of sea-bathing it is impossible to separate the effects of sea-air from that of the sea-water. The sea-bather is also constantly inhaling the spray of the sea-water, and thus obtains whatever benefit is to be got in this way. If he can swim he

enjoys all the benefit of exercise. The motion of the water and the buffeting he gets from the waves act as a powerful excitant to the skin, and lastly, the salt in the water adds considerably to the stimulating action. Reaction more readily occurs after a sea-bath than after a river-bath, and thus the liability to "catch cold" is less, although the popular belief that it is impossible to take cold from a wetting with salt water is far from being true. Besides the water of the sea, there are many other *natural salt waters* which have a great reputation both for bathing and drinking. These salt waters, which may be got of all strengths, from a strong natural brine to a water in which the salt is scarcely recognisable, all owe their stimulating power, as does sea-water, to the chloride of sodium (common salt) and other chlorides which they contain. Salt-water baths, or sool baths as they have been called, act as powerful stimulants to the skin, and have a very great reputation in Germany and other places, where the only seaboard is the ungenial northern coast.

There are many *natural mineral waters* which contain ingredients other than common salt, and all of these are much used for bathing. We shall give some details of these when we come to speak of bathing resorts, and at present we shall content ourselves by giving merely a rough classification of them.

1. Many waters issue from the ground at a temperature sufficiently hot, or even too hot (e.g. the geysers in Iceland) for bathing. Some of these natural hot waters contain very small quantities indeed of mineral matters, and these are known as *indifferent thermal springs*.

2. Mineral waters containing common salt have been already alluded to. They are known as *salt springs*.

3. The so-called *alkaline springs* contain as their chief ingredient carbonate of soda. These waters are more used for drinking than for bathing. The alkali which they contain helps undoubtedly to soften the skin of the bather, and acts probably also as a stimulant to the surface.

4. The waters containing bitter *purgative salts*, such as Epsom salt or Glauber's salt, owe their reputation almost entirely to their power when taken internally. When used for bathing it is probable that these natural solutions of purgative salts are more stimulating to the skin than ordinary water.

5. The natural *chalybeate waters*, or waters containing iron, are but little used for bathing, and it is exceedingly unlikely that the iron contained in the water has any effect upon the bather.

Although we have classified the waters, and have used that classification which is generally adopted, it must be remembered that the ingredients of waters are always

multiple, and we usually find that they contain alkaline salts, purging salts, iron salts, and brine salts mixed together, so that it is difficult sometimes to determine which is the predominating ingredient, and therefore to which class a mineral water properly belongs. All water contains gas of some kind dissolved in it, and it is well known that a glass of ordinary spring water may be seen to contain bubbles of gas which adhere to the sides of the glass, or come "winking at the brim." The gases which waters principally contain are atmospheric air, nitrogen, carbonic acid, and sulphuretted hydrogen, and great stress has been laid upon the presence in bathing waters of the three last-named gases.

The action of bubbles of gas contained in water is, in part at least, easy to understand. These bubbles give great mobility to the water, and thus the particles of water in contact with the skin are incessantly changing. Gas is soon driven out of water by the application of heat, and it is only the cooler of the thermal springs which remain charged with any considerable quantity of gas after the natural pressure, to which they have been subjected in the earth, has been removed.

The bubbles of gas, contained in the various gaseous waters, resting upon the surface of the body, produce an agreeable sensation of mild stimulation not unlike that which we feel when the surface of the body is gently

tickled. The gaseous baths belong necessarily to the category of cool baths, and it is important to remember that waters which have been boiled no longer retain any gas, which is all expelled during the process of ebullition. When a gaseous water issues from the earth at a temperature too low for bathing purposes, it is very important that the water should be heated only to the temperature required for bathing, which is generally between 60° Fahr. and 98° Fahr. This is effected usually by means of a coil of hot water or steam-pipes beneath the bottom of the bath, and, by turning a tap, the bath attendant can produce any temperature which may be desired in a very short time. Water which has been previously *boiled or heated to a high temperature*, and has been allowed to cool to fit it for bathing purposes, contains very little or no gas, and cannot be regarded as constituting a gaseous bath. Intending bathers should inquire very carefully into the manner of heating baths at these establishments. If the natural gaseous water be collected in reservoirs, and be allowed to lie in these reservoirs for any length of time before being used for the baths, the greater part of the contained gas will escape, and there will be a great discrepancy between the actual condition of the water used and the published analysis of such water.

It is exceedingly unlikely that either carbonic acid or

nitrogen contained in water is absorbed by the skin. The effect of these gaseous baths is due to their physical condition only (at least we have no satisfactory evidence to the contrary), and in no way to the absorption of the contained gases. Carbonic acid is only absorbed by the skin under the influence of great pressure, and when thus absorbed it produces a poisonous effect.

At some bathing establishments, so-called baths of pure carbonic acid are administered, the patient being made to sit in a reservoir of the pure gas, but, of course, with his head out. We have also seen arrangements for directing a jet of carbonic acid gas upon different regions of the body, but we should be sorry to hazard any opinion as to the *modus operandi*, or the results of such a practice.

In an ordinary water-bath, strongly impregnated with carbonic acid, there is occasionally some danger of too much gas escaping, and being consequently inhaled in undue quantities by the occupant of the bath.

Sulphur baths, or baths impregnated with sulphuretted hydrogen gas, and having the well-known and offensive odour of rotten eggs, have been used as remedies in disease from time immemorial. It must be remembered that the so-called "sulphur waters" are of a very complex nature, and contain many saline ingredients, in addition to the sulphides of lime or soda, to the decomposition of which the presence of the characteristic gas is due. Most

of these waters have also a high temperature, so that they must be considered as hot salt waters, with the addition of sulphuretted hydrogen, and it becomes a difficult matter to determine to which of their ingredients any good effect which they may produce is due. It must be borne in mind, also, that the amount of sulphuretted hydrogen contained even in the strongest of these waters, notwithstanding that it is amply sufficient to offend the sense of smell, is in reality very small, and there is no evidence that this gas is ever absorbed through the skin from the bath. People who visit sulphur baths generally drink the water, and while bathing they certainly inhale an atmosphere more or less charged with sulphuretted hydrogen. The general opinion at present is, that the effect of sulphur waters, when used for baths, is the same as that of other hot and saline springs, and that the sulphuretted hydrogen in the water is inoperative. At some of the sulphur baths the attendants point to a peculiar eruption on the skin, called *La Pousseé*, as evidence of the peculiar effect of sulphur, but this eruption does not differ from that which so often results after a prolonged use of baths of any kind.

There is no end to the varieties of baths which have been used at one time and another for the relief of sickness, and we shall content ourselves by a short allusion to some of the best known.

Mud baths, or moor baths, are much used in some parts of Germany. They consist of water mixed with moor earth, or the mud deposited by some of the mineral springs. The resulting compound is thick and stodgy, and, like loosely-made farinaceous puddings. They cool unequally, and retain their heat for very long periods in the middle. Chemically they are composed of the various matters, soluble and insoluble, animal, vegetable, and mineral, of which mud or moor earth is formed. Much of their virtue has been ascribed to *formic acid*, a volatile body formed by ants, having a very pungent odour and considerable stimulating power. These baths are generally supposed to exert a very powerful action upon the skin.

Pine baths are in great repute in regions where pine-trees are plentiful, as in the Black Forest, the Harz Mountains, and elsewhere. A decoction is made of the fragrant tops of the pine-trees, and this is added to the baths in varying quantities. It is also largely exported in a concentrated form from the regions in which it is made. The smell of the pine extract is most delicious, and the resin which it contains has an undoubted stimulating action upon the skin.

Blood, milk and whey, as well as various broths and decoctions of meat, have been used in the belief that they imparted strength to the bather. It is indeed a practice in some northern countries, even in the present day, to

envelop a weak or dying patient in the skin of a freshly killed animal, the invalid thereby being supposed to imbibe some of the vital power of the recently slaughtered beast.

On the banks of the Nile, *slime* has been used as a bath, and in some places *sea-mud* has been used for the same purpose. *Sand baths*, or arenation, belong to the remedies which are hallowed by antiquity. The patient is buried in the sand, and exposed to the full rays of the sun, and the combined effect of the heat and the surface irritation produces a copious perspiration. At some sea-bathing establishments *baths of sea-weed* are given, under the name of ozone baths, from the belief, right or wrong, that sea-weed is impregnated with ozone. In some old works we find *baths of dung* strongly recommended ; and even at the present day it is the practice, among some of the half-civilised Eastern nations, to smear the body with dung for the cure of all varieties of ailments. Various refuse matters have been used as baths, among which we may mention the *husk of the grape*, in countries where the vine is largely cultivated, and the *refuse of the olive* in oil-making countries.

Medicated baths may be artificially prepared, and many such are in common use in medicine. Among these we may mention—

1. The group of so-called *emollient* baths, which have the following composition : To thirty gallons of water,

there may be added from two to six pounds of *bran*; or a pound of *potato flour*; or a couple of pounds of *gelatine*; or a pound of *linseed meal*; or four pounds of *marsh mallow*, or other herbs.

2. *Alkaline baths* are made by adding to thirty gallons of water, from four to six ounces of carbonate of soda or potash, and occasionally an equal quantity of borax.

3. *Acid baths* contain an ounce or more of muriatic, nitric or nitro-muriatic acid, to each thirty gallons of water.

4. Iodine or Bromine may be added to baths.

The medicated vapour baths are of two kinds, *mercurial* and *sulphur*, both being contrived by evaporating flour of sulphur or calomel in an iron pan. The sulphur bath thus administered emits the pungent and suffocating vapour of sulphurous acid, the effects of which must be exerted solely upon the body of the patient, since the inhalation of any quantity, if not fatal, would prove a very serious annoyance. We must not forget to mention the old domestic remedy of a bath of *mustard and water*, which is among the most powerful stimulants to the skin which we possess.

The *Galvanic Bath* has been much talked about of late years, and it becomes necessary that we should discuss its merits. It consists merely of a bath of water, through which a galvanic current is passed. It can be

easily administered in the following way :—Place an ordinary bath upon a sheet of mackintosh, which, being a non-conductor of electricity, has the effect of insulating the bath, as it is termed. Then fill the bath with warm water to a convenient height, and to the water add a handful of salt or a wine-glassful of vinegar in order to increase its conducting power. Next get a galvanic battery, one having 30 or 40 Leclanché Elements is sufficient, and place it on a chair or on the floor beside the bath. To each of the poles of this battery, positive and negative, affix a suitable length (3 or 4 yards) of insulated telegraph wire, having its extremities freed from the gutta-percha or other insulating material. Place a length of stout broom-handle across the bath, resting on its two edges, and round the middle of this twine the bright metal end of the wire in connection with the positive pole of the battery, covering it with a piece of flannel, or wrapping it round with a sponge. The bather then gets into the bath, and takes hold of the centre of the broom-handle, previously moistened, so that his hands are out of the bath. The end of the negative wire is then placed in the bath itself, and as this is done the bather will feel the shock of the electric current. The current in this case travels from the positive pole of the battery through the wire to the broom-handle, down the patient's arms, through his body

to the water of the bath, and so to the negative pole. This form of bath is a very powerful stimulant to the skin, but beyond its action on the skin we know nothing. It is said that by its aid it is possible to extract metallic bodies, such as mercury or lead, which may be lurking in the body and causing harm. Of such a power there is no evidence whatever. We have heard it said that at some galvanic baths visitors have been shown discolorations on the side of the bath as evidence of deposits of mercury, &c., but this is merely a quackish imposition, and it is well that persons should be on their guard against it.

The *electro-magnetic* bath is given in the same way as the galvanic bath, an electro-magnetic battery being substituted for the galvanic battery.

It will be well to close the chapter by offering a few hints to bathers, and by laying down a few rules for their guidance. Bathing, in all its forms, increases the internal work of the body; it increases the action of the heart, the rate of respiration, the rapidity of circulation, the rate of tissue change, and, in the case of hot baths, the rate of perspiration through the skin. This necessarily makes a call upon the vital forces, and causes a certain amount of exhaustion. From this it follows that baths are best not taken at a time when the body is much exhausted, and that exhausting exercise should

not be indulged in after a bath until a considerable period of time has elapsed.

Again, since bathing invariably affects the distribution of the blood, causing, as the case may be, either a degree of bloodlessness in internal organs, or, if the bath be cold, an undue congestion of them, it is important not to overtax those organs during the period of bathing. It is, therefore, never advisable to bathe directly before or directly after a meal, since in both cases a want of digestion of the material in the stomach is likely to result.

Ancient writers are most explicit in their directions for bathers. Thus Hippocrates, the Father of Medicine, writing some four centuries before the Christian era, says : "The person who takes the bath should be orderly and reserved in his manner, should do nothing for himself, but others should pour the water upon him and rub him ; and plenty of water, of various temperatures, should be in readiness for the *douche*, and the affusions quickly made ; and sponges should be used instead of the strigil, and the body should be anointed when not quite dry. . . . And a man should not be washed immediately after he has taken a draught of Ptisan, or a drink ; neither should he take Ptisan as a drink immediately after the bath." These directions are for the use of invalids, such as are acutely ill, and the writer seems fully to recognise that bathing in itself is an exhausting process. This

allusion to Ptisan is interesting, as showing how some of our commonest domestic remedies come to us from a remote antiquity. The Greek word *πρωάνη* signifies peeled (or "pearl") barley, and the drink made from it, the barley-water of to-day.

As we have before mentioned incidentally, the proper ventilation of the bathroom is a matter of prime importance; for since the respiration is quickened by the act of bathing, it is evident that a foul atmosphere in the bathroom is very liable to produce an ill-effect upon the bather. Many of the swimming baths in London are very defective in this respect, and we have been forcibly struck, in more than one of them, by the ammoniacal odour proceeding from those sanitary offices which are a necessary adjunct to every bathing establishment. It is a very common custom in private houses to place the bath and the water-closet in the same apartment. That this is an undesirable arrangement is evident, for the water-closet is, of all places in a house, that in which a foul atmosphere is most likely to be encountered. Although a bathroom should be well ventilated, it should certainly not be draughty, for currents of cold air blowing upon the moist skin of the bather are likely to give "cold," and produce internal congestions of various kinds. In summer there is no difficulty in providing a sufficiency of fresh air, but in winter it is not so easy. The best way,

perhaps, to provide for a constant renewal of air is to admit air by means of vertical tubes, and to have in the room an open fireplace, in which a brisk fire should be burning while the bath is being administered.

In order to ensure a proper reaction after a cold bath, and to prevent chill after a hot one, it is customary to provide the bather with a supply of hot linen. This is a great comfort and a luxury, and may even be looked upon as an absolute necessity for delicate persons. It is a very general custom on the Continent for the bather, after removing the greater part of the moisture from his body, to don a hot calico Peignoir, or bathing-gown, which protects from chill, and at the same time allows of the limbs being rubbed with towels. It is not necessary to say much about towels. They are to be got of all qualities, from those as soft as a cambric handkerchief to those which, in roughness, approach the qualities of a curricomb. The bather may please himself in this matter, and will choose a soft absorbent towel to remove the moisture, and a hard one to rub the surface and produce the necessary reaction. Horsehair gloves and various rubbers made of indiarubber, &c., are in use, and require only to be mentioned.

Friction and shampooing are valuable accessories to bathing, and serve, as it were, to take the place of exercise in those diseases in which the patient is unable to

exercise his body thoroughly for himself. Friction is applied to the skin merely to rub off the surface layers of epithelium, to encourage the dilatation of the superficial vessels, and the transudation of the sweat. Shampooing is a deeper and more forcible kind of friction, in which the rubber kneads the muscles and allows his fingers to press steadily upon and between them. This acts as a stimulant to the muscles themselves, much in the same way, but in a far milder degree, as an electric battery acts upon them. It must be borne in mind, however, that friction and shampooing are both exhausting, and must not be used to excess. While a patient is being shampooed, he involuntarily resists the pressure of the shampooer, and we have seen a patient reduced to a state of considerable exhaustion, after having been for twenty minutes in the hands of a professional rubber.

It is not necessary to make any remarks on the subject of soaps. Their name is Legion, and the bather, guided by the light of common sense, may make his choice. The ancients were accustomed to anoint their bodies with a variety of smegmata, unguents and oils, both during and after bathing.

As to the temperature of the bath and its duration, although these are both very important questions, it is impossible to lay down any exact rules, for they must be settled according to the condition of the bather. A

physician, in ordering a course of baths for an invalid, should state, in writing (in the form of a prescription) the frequency, variety, temperature, and duration, as well as the time of day at which they are to be taken.

After a hot bath it is sometimes necessary to arrange that a weakly patient shall go to bed for a couple of hours or more. To slake the thirst, both during and after a bath, there is nothing better than pure water.

CHAPTER III.

BATHING LOCALITIES.

IN considering the various bathing localities it is only natural that we should begin with London. We have no intention of speaking in detail of the various baths with which private enterprise has provided the inhabitants of London, for such a course would be quite foreign to the intentions of this little work, which is intended merely to furnish the reader with a few general principles which shall be of use to him in selecting a bath. There is no kind of bath which cannot be got in London, and between a dip in the Serpentine and the elaborate process of the Turkish bath the bather has a wide choice. In proportion to its size and the number

of its inhabitants, however, the bathing accommodation is very bad. The Thames is still a foul stream, and few care to plunge into the sewage which flows down from Richmond and surges back again from Barking. It is true that we have one large swimming bath floating close to Hungerford Bridge, the water of which is filtered in an ingenious way; but it may safely be said that, were the water of the river cleaner, we should have fifty such baths instead of one. We have often thought that a bathing establishment on a really grand scale would be a success in London, and we hope some day to see baths in our great metropolis, which should remind one of the palatial establishment of Caracalla. A combination of a swimming bath, private baths, Turkish baths, &c., with a first-rate gymnasium, reading-room, lecture hall, and refreshment room, would surely meet with sufficient patronage to pay, and we even believe that the introduction of sea-water for such a purpose (an undertaking which has been started more than once) would be sufficiently appreciated to ensure a dividend to the promoters.

England is naturally very well supplied with sea-bathing resorts, and it is possible to get a sea-bath in our island combined with any variety of climate, from the cold and bracing to the mild and relaxing. Sea-air, the great value of which is well understood as a curative agent, has certain peculiarities. It is necessarily the purest air that

can be got, and when the breeze is off the sea the air comes to the shore practically uncontaminated and free from the exhalations of animals or furnaces. It is said to be very rich in ozone, and it certainly contains fine saline particles supplied to it by the sea-spray, and possibly small quantities of iodine, which give to the sea-breeze that peculiar odour which it undoubtedly possesses. Sea-air is dense, and the barometer stands at its maximum at the sea-level. Sea-air is warmer than the air of inland places, and it is more equable in its temperature owing to the comparatively slight changes in temperature which the sea itself undergoes. The effect of sea-air is very stimulating, and sojourners by the sea have their appetites increased and their vital functions quickened. While speaking of sea-air we must remind the reader that the air of the seaside places is often far from good, owing to the defective sanitary arrangements. There are not a few towns on our coasts, the sewers of which are taken out on to the beach where visitors most do congregate, and the smell of sewage at low tide is often far from pleasant. In selecting a sea-bathing place it is of importance to attend, not only to the aspect and general situation of the town, but to inform oneself whether or not it be thoroughly drained, the sewers being carried either inland to a proper sewage farm or far out to sea well beyond low-water mark ; whether the water supply for

drinking purposes be good and abundant, and whether the general cleanliness of the town is properly attended to. Climate is a very local phenomenon, and it is of as much importance to see that the bedroom and sitting-room which an invalid has to occupy are well ventilated and have a good aspect, as to attend to the latitude and general aspect of the locality chosen. It is of little use to send a patient to the sea if he has to spend the greater part of his time in small rooms made unbearable by gaslights or the defective drainage of the house; and an invalid with delicate lungs will derive but little benefit from a sojourn in the south if his windows face the north and he is afraid to open them.

As to the time of year at which sea-baths should be taken, that of course depends upon the locality visited. On the east coast, in situations which are exposed to winds from the north and east, bathing is only advisable during the three summer months of June, July, and August. On the west coast it is possible to begin a little earlier, and continue a little later; and in some situations in the south, the season may be said to extend from the middle of April to November. In these latter places, the temperature at midsummer is often unpleasantly high, and the bathing season falls into abeyance for a time. There are many considerations which influence people in their choice of a bathing station, such as the size of a

town, or whether it be gay or quiet ; its distance from London, its accessibility, the accommodation, the expense, &c. A more important point, perhaps, is the nature of the bottom, whether it be sandy or shingly. The great popularity of the bathing resorts on the north coast of France and the Belgian coast is due to the great expanse of fine sand of which the bottom is composed.

In selecting a bathing place it is advisable, if reliable information is not forthcoming from those who know it well, to look at the Ordnance map of the town and district, and learn from an inspection of it, not only the direction in which the locality looks sea-ward, but the nature of the immediate surroundings of it ; the position and height of cliffs and hills, and the amount of protection against cold or heat. The nature of the soil should also be ascertained, and the prevailing character of the vegetation, and, if possible, the amount of rainfall and the mean temperature of summer and winter.

Many watering places possess, in a very restricted area, many climates. Let us look at such a watering place as Bournemouth, and we shall be able to explain what we mean. Bournemouth is a town of some six or seven thousand inhabitants, built on a sandy soil, surrounded by pine woods. It faces the south ; the average rainfall is 30 inches per annum ; the temperature is equable, and frosts are comparatively rare, the mean night temperature

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in the month of January being 35·6. The town is built upon two bold cliffs, with a dip between them, and the surface of the soil being very uneven, it is thus possible to get almost any climate. In the dip between the cliffs are situations exposed only to the south, and protected from all cold winds; and others facing only to the north. On the east cliff one may live in a pine-wood, with the advantages of moderate elevation, a southern aspect, and the protection of trees which have the double advantage of being evergreen, and possessing a foliage which does not rot and decompose in autumn. On the west cliff, again, one may live in a house exposed to every wind that blows, in a climate which may very justly be spoken of as bracing.

It seems unnecessary to catalogue the various sea-bathing resorts in Great Britain. They are numberless, and intending visitors are influenced mainly by questions of accessibility and accommodation. Those on the east coast are mostly bracing, those on the west are more relaxing, while those on the southern coast are mostly warm and available during the winter months. We must refer our readers to the various guide-books and gazetteers for detailed information.

We have next to consider the various mineral baths scattered about Europe, and it must be admitted that the arrangements for bathing at the various sources of mineral

WATER

waters are much better carried out on the Continent than in this country. In any course of treatment bathing is generally only one element of the regimen to which an invalid is directed to submit. Diet, climate, rest, and exercise, and the internal administration of medicine or of mineral water, often are called into requisition to perform their share in the cure ; and while a patient is bathing, and by bathing is stimulating or facilitating his animal functions, it is of the greatest importance that he should live the healthiest life imaginable. At most of the German baths a somewhat strict surveillance of the bathers is maintained, and at those which have the greatest reputation, it is almost impossible to get, in the shape of food, anything of which the local physicians would disapprove. It is too often the habit of the Englishman to go to a bath without taking any advice as to his general mode of life while bathing, or even whether he may expect benefit or harm from the treatment he is prescribing for himself. The foreigner, on the other hand, submits in all things to authority, and while " undergoing a cure " he is content to have his time of rising and going to bed, his meals, his exercise, his baths, and other treatment, all accurately regulated for him. It is on this account, no doubt, that the German and French baths have so great a reputation, for while visiting them the guests live by rule just as athletes do in this country when they

wish to bring themselves to the highest pitch of health attainable in view of some muscular contest. When the Englishman is told to visit this or that continental spring, he may well ask, as did the captain of the host, "Are not Abana and Pharpar, rivers of Damascus, better than all the waters of Israel? May I not wash in them, and be clean?" He must remember, however, that, as in Naaman's case, obedience to the directions of the prophet resulted in a cure, so he must seek out a spring where he will find a prophet; to whose dictation he must be willing for a time in all things to submit.

When people visit a mineral spring they generally do so with the double object of drinking the water and of bathing in it; with the drinking of mineral water we have, in this volume, nothing to do, but merely with bathing, and the reader will have gathered from the previous chapters, that, when bathing only is concerned, the exact composition of the water is not a matter of very great importance; since all baths act in the same way, by stimulating the skin, and the water of the bath is probably *never absorbed*. It is important to insist upon this point, because we find in several bath-puffs the assertion that their effect is due to the absorption through the skin of the material dissolved in the water of the bath. Such an assertion is contrary to the teaching of our leading physiologists. At all sea-bathing places the

climate is, in one respect, the amount of barometric pressure, similar. The advantage of mineral baths over sea-baths very greatly lies in the fact that we are not only able to choose our water but also to choose our climate, and to have either a mountain climate with low barometric pressure, or a sea-level climate with a high barometric pressure, or a climate where the barometric pressure is intermediate between these two extremes.

We must, in order to bring the effects of mountain climates vividly before the mind of the reader, refer again to the comparison which we have made elsewhere between the burning of fuel in a furnace, and the combustion which is constantly going on in our bodies. Experiments made by Professors Tyndall and Frankland on the combustion of candles at different altitudes, seem to give the clue to the explanation of the effects of mountain air upon our bodies. These gentlemen burnt candles of equal weight, and under similar conditions at Chamouni, and also on the top of Mont Blanc, which is 12,000 feet higher. They found that the amount of candle consumed in equal periods of time was the same in both situations, but that on the top of the mountain the candle gave out considerably *less light* than it did in the valley. The diminution of the light was attributed with justice to the *completeness* of the combustion, for the light emitted by a flame is mainly due to the unconsumed particles of carbon in a

state of incandescence. Mountain air, being much more rarified than the air of low-lying valleys, contains much less oxygen in proportion to volume, but its lesser density seems to enable the oxygen to assume, as it were, a greater activity.

It has also been found that bodies lose heat less rapidly in rarified atmospheres, so that presumably there is less need for heat-production on the mountain than on the plain; so that in mountain climates the body is saved a certain proportion of the combustion necessary for the generation of heat.

Mountain air is pure, and removed from miasmata and exhalations, whether from marshes or (being usually sparsely inhabited) men. It is usually still and seldom foggy. The variations of temperature are very great and very rapid, the visitor having often to undergo, within a few hours, a tropical and an arctic climate. These rapid variations serve probably to stimulate vital processes, and there can be little doubt that they are important factors in the general effect produced by mountain climates.

The following notes made during a sojourn at Davos in Switzerland may serve to bring some of the above facts in a more concrete form before the reader. "The height above sea-level is between 5000 and 6000 feet, and the barometer stands at about an average of 620 millimètres, instead of 760, which is its average height

at the sea-level, so that the weight of the atmosphere is only $\frac{4}{7}\frac{2}{8}\frac{0}{0}$, or rather more than three-fourths of what to most of us is its normal weight. The result of this is that under the influence of the sun's rays evaporation is marvellously rapid. The dew is gone in an instant, and the vapours of the early morning seem to vanish at the first touch of the solar heat. Thus it follows that although the rainfall is considerable, the dryness of the air is, during the main part of the day, nearly absolute. The range of temperature is apt to be very great, and the thermometer, even in the height of summer, is frequently below freezing point in the early morning and in the shade, while in the sunshine, towards midday, the heat is simply scorching. For the most part, however, the temperature is very pleasant in summer; and even invalids, if properly provided with wraps, may spend almost all the hours of daylight out of doors. The obvious results on a healthy person of living in such a climate are (1) a slight increase in the rate of pulse and respiration; (2) a craving for and an ease in performing muscular exercise; and (3) a marked increase of the appetite, with a general feeling of exhilaration. The air acts, in fact, as a powerful stimulant. Ladies, and those who are not able to take much exercise, often have a difficulty in sleeping, but this is never of long continuance. Owing, it is said, to the diminished atmo-

spheric pressure, the cutaneous blood-vessels dilate, and the complexion becomes (with the help of the sun) exceedingly ruddy, a fact which is particularly noticeable in the inhabitants, whose red cheeks strike a stranger with astonishment."

There are of course many things to be considered in making selection of a bath besides the height above sea-level. Attention must be paid to the local configuration of the district, and the sanitary condition of the town or village in which the healing spring is situated. It is manifestly unadvisable for an invalid who has been sent to the Alps for the benefit of a mountain climate to settle down in some narrow gorge, exposed perhaps, only to one wind, into which the sun only peeps at midday, where the climate knows no medium between the two extremes of heat and cold, where the river perhaps has been converted into an open sewer by the inhabitants, and where the population is a mixture of the Goitrous and the Cretinous. Such localities are to be found, and it may well happen that the invalid may go to the bath to be cured of his gout, and return with typhoid or ague. Some few years back the writer was travelling in the Vosges mountains, and stopped a night at a well-known watering-place, taking up his abode in the Bad-haus. The situation of the town was extremely picturesque; the valley in which it lay was verdant, the hills

were well clothed with foliage, and the mineral springs of the district were such as might well be recommended to many patients. The inhabitants, however, had seen fit to turn the lovely stream which meandered through the valley into a sewer. Into it abominations of every kind were thrown, and its pebbly bottom had become obscured by broken crockery, old tin pots, old boots and shoes, and other refuse. The swine were driven into it every morning as if on purpose to defile it, and what should have been one of the chief attractions of the district had become a pestilential nuisance, exhaling filthy odours, and fit only to be bridged over and hidden absolutely from the light. It is not sufficient in making choice of a bathing place to consider only those dry facts which are capable of being stated in figures, but the intending bather should seek reliable information as to the sanitary condition of the town, as well as of the hotel or lodging-house which he proposes to inhabit. This information is only to be got from disinterested patients who have made a sojourn in the locality. Guide books are seldom to be trusted, and special treatises on the virtues of this or that bath are to be regarded as the works of a fervid imagination in the absence of confirmatory evidence. The most potent cause in establishing the popularity of this or that bathing place has been the heat of the water, and there is perhaps no hot spring

in Europe which was not used for bathing by the Romans, or which has not been used from times of remote antiquity by the inhabitants of the district. It is so convenient and so cheap to have hot water ready to hand without the necessity of huge furnaces, enormous chimneys, expensive boilers, and endless pipes, that it is not surprising that such a valuable natural gift should be appreciated.

The best known hot bath in this country is the one at *Bath*, in Somersetshire, the water of which proved so attractive to the Romans that they founded the city of *Aquæ Solis* here, in the 1st century of the Christian era. It is needless for us to dwell upon the popularity of Bath. There are four hot springs here which vary in temperature between 120° Fahr. and 104° Fahr. The supply of water is ample and abundant, and the accommodation for guests such as can hardly be surpassed. The corporation of the city have lately erected a magnificent suite of baths, and if they will but turn their attention to the condition of the river Avon, and rigidly enforce the provisions of the Pollution of Rivers Act, Bath may again become as popular as it was in the days of Beau Nash. The elevation of Bath above the sea-level is only about 100 feet. The constituents of the Bath water are chiefly sulphate of lime with a little carbonate of iron, together with some free carbonic acid

and nitrogen. It has been called an earthy water, but perhaps it is better to regard it as a simple hot water, the chief virtue of which is its warmth.

Buxton, in Derbyshire, is situated nearly 1000 feet above the sea-level in an open hollow surrounded by hills. There is good reason to believe that the water of Buxton was known to the Romans. The temperature of the Buxton water is 82° Fahr. The amount of saline ingredients is but small. The water is, however, impregnated with a large quantity both of carbonic acid and nitrogen gas. The town is amply provided with accommodation both for bathing and lodging.

At *Clifton*, near Bristol, there are springs having a temperature of 74° Fahr., and at *Mallow*, in Ireland, is a spring having a temperature of about 70° Fahr., and containing, like the water of Buxton, a large quantity of free nitrogen gas. A great deal has been written about the virtues of free nitrogen in water, but without, as it seems to us, sufficient evidence.

There are many hot springs in Europe which are very largely frequented by invalids. We can, however, do little more than tabulate the chief, indifferent, and earthy thermal springs, giving the chief facts concerning each.

At *Leuk*, in Switzerland, situated at the foot of the Gemmi Pass, we find a water possessing a natural tem-

perature of 102° Fahr. to 120° Fahr., situated 4600 feet above the sea-level. The water is indifferent, and it is the custom here for bathers to remain many hours consecutively in the water. Ladies and gentlemen bathe in the same bath, and it is no uncommon thing for the bathers to be seen taking their luncheon or playing dominoes upon floating tables.

At *Pfaffers* and *Ragatz*, near the town of Coire, in Switzerland, are found indifferent springs, situated between 1500 and 2000 feet above the sea-level, and having a temperature of 100° Fahr.

Gastein is a much frequented and very fashionable bath in the Austrian Salzkammergut, some twelve or thirteen hours' drive from Salzburg. The height above sea-level is 3300 feet, and the temperature of the water varies from 96° Fahr. to 114° Fahr.

Bormio, at the foot of the Stelvio Pass, on the southern slope of the Alps, has an altitude of over 4000 feet, and water of a temperature of 104° Fahr.

Wildbad, in the Black Forest, has been for many years a favourite bath with the English. The elevation is 1300 feet, and the temperature of the water a little over 100° Fahr.

Wiesbaden, the capital of Nassau, possesses both hot and cold springs. The former have a temperature of 160° Fahr., and contain a fair amount of chlorides. The

town is beautifully situated among the Taunus Hills, and has an elevation of 300 feet above the sea-level.

Teplitz, in Bohemia, is a fashionable bathing resort. The town is well ordered, and healthfully situated, being 600 feet above the sea-level, and supplied with natural thermal springs, having a temperature ranging from 78° Fahr. to 120° Fahr.

Schlangenbad, among the Taunus Hills, is a quiet bathing-place, with a natural tepid water having a temperature ranging between 80° and 90° Fahr. The Schlangenbad water only contains 2½ grains of solids to the pint, so that it may safely be regarded as an "indifferent" spring. Sir Francis Head, the author of the 'Bubbles from the Brunnens of Nassau,' visited Schlangenbad in 1836, and we feel constrained to make the following extract from his work, as typically illustrating the kind of belief which gathers round a natural spring:—

"In the history of the little Duchy of Nassau, the discovery of this spring forms a story full of innocence and simplicity. Once upon a time there was a heifer, with which everything in nature seemed to disagree. The more she ate the thinner she grew; the more her mother licked her hide, the rougher and the more staring was her coat. Not a fly in the forest would bite her; never was she seen to chew the cud, but, hidebound and melancholy, her hips seemed actually to be protruding from

her skin. What was the matter with her no one knew ; what could cure her no one could divine. In short, deserted by her master and her species, she was, as the faculty would term it, 'given over.' In a few weeks, however, she suddenly reappeared among the herd, with ribs covered with flesh, eyes like a deer, and skin sleek as a mole's ; breath sweetly smelling of milk, saliva hanging in ringlets from her jaw ! Every day seemed to re-establish her health, and the phenomenon was so striking that the herdsman, feeling induced to watch her, discovered that regularly every evening she wormed her way in secret into the forest, until she reached an unknown spring of water, from which, having refreshed herself, she quietly returned to the valley. This trifling circumstance, scarcely known, was almost forgotten by the peasant, when a young Nassau lady began to show exactly the same incomprehensible symptoms as the heifer. Mother, sisters, friends, father, all tried to cure her, but in vain, and the physician had actually

' Taken his leave with sighs and sorrow,
Despairing of his fee to-morrow,'

when the herdsman, happening to hear of her case, prevailed upon her at last to try the heifer's secret remedy. She did so, and in a very short time, to the utter astonishment of her friends, she became one of the stoutest and

roundest young women in the duchy." Sir Francis Head goes on to describe how he was conducted along subterranean passages to the source of the baths, and was astonished to find serpents swimming in the water, and still more astonished to hear his cicerone declare, "*C'est ce qui donne la qualité à ces eaux!*" Schlangen, or serpents, are very common in this part of the duchy of Nassau, and hence the name Schlangenbad.

Baden-Baden is at once one of the most frequented and most picturesque baths in Europe. The temperature of the water varies from 115° Fahr. to 144° Fahr, and the elevation above the sea-level is 616 feet. The waters contain only 22 grains of solid ingredients to the pint, the chief of which is common salt (16½ grains).

The celebrated hot purgative water of *Carlsbad*, although formerly used for bathing, is now chiefly employed for drinking.

Bathing is carried on to a very large extent at *Vichy* (in the Department of Allier, in France), although these waters are chiefly used as internal remedies.

Plombières, among the Vosges Mountains, has an elevation of 1310 feet. The water contains only 2 grains of solid ingredients to the pint, but the temperature is high, varying from 80° Fahr. to 160° Fahr.

Some of the hot springs at *Ems*, such as the Fürstenbrunnen, with a temperature of 95° Fahr., and the

Neuequelle, with a temperature of 117° Fahr., are used for bathing.

At *Aix-les-Bains*, in Savoy, 768 feet above the sea-level, will be found two hot springs, varying in temperature from 106° Fahr. to 116° Fahr. These waters contain less than 4 grains of solid ingredients to the pint, but one of them, containing an appreciable amount of sulphuretted hydrogen, is known as the sulphur spring. Aix was known to the Romans, and in the modern town will be found every bathing appliance which art can contrive.

At *Mont Doré* and at *Bourboule*, in the department of Puy de Dôme, in France, at an elevation of 3400 feet above the sea, are thermal springs having a temperature of 104° Fahr. to 114° Fahr.

Having enumerated the chief warm baths in Europe, we will proceed to catalogue some of the best known of the salt baths.

Droitwich, in Worcestershire, is perhaps the only place in England where concentrated salt baths can be obtained. The brine of Droitwich is said to contain as much as 2760 grains to the pint. The town is uninteresting.

At *Ischl*, in the Salzkammergut, is a concentrated brine containing 1900 grains to the pint. It is 2000 feet above the sea-level, and the country is charmingly picturesque.

Kreuznach, not far from Bingen on the Rhine, has a strong salt spring, and is much resorted to by scrofulous

patients. The mother-lye of Kreuznach is said to contain 2400 grains to the pint. These strong brines are only used after proper dilution.

The water of *Soden*, in the Taunus hills, contains 160 grains to the pint; and at *Homburg* are found several springs which have about 90 grains to the pint.

Kissingen is a fashionable watering place in the north of Bavaria, with an elevation of about 800 feet above the sea-level. Here will be found all the accessories of bath life. The water contains about 60 grains of solid ingredients to the pint.

The *Wood Hall Spa*, near Lincoln, is a salt spring containing as much as 160 grains to the pint.

Rehme, in Westphalia, is situated on the Cologne and Minden railway. The water has nearly 250 grains of salt to the pint, and is very highly charged with carbonic acid. The natural temperature of the water is 92° Fahr. There is every facility at Rehme for administering baths of all kinds and of all degrees of concentration.

Nauheim is not far from Homburg, among the Taunus hills, and possesses a water very similar to that of Rehme, having from 170 to 291 grains to the pint, being highly charged with carbonic acid, and having a temperature of from 80° Fahr. to 94° Fahr. The elevation of Nauheim above the sea-level is 450 feet. The salt baths of Rehme and Nauheim enjoy a very wide reputation.

Although sulphur waters are not so much used for bathing as formerly was the case, this little book would not be complete without some notice of the chief sulphur springs.

Harrogate, in Yorkshire, has been well known for more than three centuries, and although the sulphuretted hydrogen, by its predominant smell, gives the chief character to the Harrogate springs, they have an equal claim to be called saline or chalybeate, for they are strongly impregnated with salt and with iron, so that the taste has been compared to a mixture of rotten eggs and the scourgings of a gun. The old sulphur spring contains 137 grains of solid contents to the pint, and is strongly impregnated with carbonic acid and sulphuretted hydrogen. Harrogate is now a fashionable watering place, with every accommodation for visitors. The situation of the town is open and airy, and the climate is decidedly bracing.

Gilsland, in Cumberland, has a sulphur spring of some repute.

The Pyrenees is the district *par excellence* of sulphur springs. *Baréges* is the most famous of the Pyrenean baths, situated 4000 feet above the level of the sea. Its water, which has a natural temperature of 86° Fahr. to 111° Fahr., contains only 1·657 grains to the pint, of which ·360 grains is sodium sulphide. This becoming

decomposed on exposure, forms the sulphuretted hydrogen which gives the character to the spring. These sulphur waters contain a peculiar gelatinous organic substance which has been called *barégine*, and which has been supposed by some authorities, but on insufficient grounds, to give the peculiar virtue to the water.

Cauterets, in the Pyrenees, 3000 feet above sea-level, with a sulphur water having a natural temperature of 98° Fahr. to 130° Fahr.

Bagnères de Luchon, 2000 feet above sea-level, with a natural hot sulphurous water.

Eaux Bonnes and *Eaux Chaudes*, 2000 feet above the sea.

At *Aix-les-Bains*, in Savoy, one of the springs is strongly impregnated with sulphur.

Aix-la-Chapelle, in Rhenish Prussia, is 450 feet above the sea. The water contains about 30 grains of solid contents to the pint, and is strongly impregnated with sulphuretted hydrogen.

Any water may be used for bathing purposes, and it is almost always the custom for visitors who go to a spring for the purpose of *drinking* the water, to take some *baths* as well, the baths often being composed of the same water as that used for drinking. It is not generally believed that there is any particular virtue in baths composed of alkaline waters, such as those to be found at Vichy, nor

in purgative waters, like those at Carlsbad, nor in iron waters like those at Tunbridge Wells, Spa or Schwalbach. Hot bathing, however, may be expected to help the effect which it is sought to bring about by taking the water internally, and it has not unfrequently been the case that the effect of drinking has been attributed to the bathing.

It is worthy of remark that, at some places where miracles are claimed to be wrought by the effect of water (as, for example, at Malvern), the water used is remarkable merely for its great purity and almost absolute freedom from mineral ingredients.

It is not a little remarkable that some waters, which were formerly used almost exclusively for *bathing*, are now used almost as exclusively for drinking. Carlsbad affords an instance of this. The word *bad*, when used as an affix, generally indicates that the water is or has been used mainly for bathing. The word *brunn*, or *brunnen*, however, usually implies that the spring has been mainly employed for drinking purposes.

CHAPTER IV.

THE USES OF BATHS.

WE do not propose to enter at all fully into the question of the place which baths ought to occupy as remedies for

disease ; but we shall merely indicate some of the chief conditions for which bathing might reasonably be expected to be of service. It has been generally claimed for baths that they cure everything ; and, in fact, the many unfounded assertions as to the remedial powers of hot and cold water, which have been made by professed hydropathists and others, has done much to bring these very useful agents into disrepute.

It proved very puzzling to the acute mind of the author of the 'Bubbles from the Brunnens,' that the baths and waters which he encountered in his travels seemed capable of curing everything ; and it was difficult to understand how patients whose conditions were in no way similar should apparently derive equal benefit from precisely the same treatment ; and perhaps we shall not be wrong in assuming that the very healthy mode of life which is pursued by visitors to baths has much to do with the good results of treatment.

The most common purpose for which baths are used is the cleansing of the skin, and the importance of this, of course, cannot be over-estimated. When we speak of a clean skin we mean a skin with clean pores as well as a clean surface. The indolent and luxurious man, whose skin is spotlessly clean, but whose sense of the proprieties is such that he never indulges in a good vulgar sweat, has not, in reality, so healthy and clean a skin as the

navvy, whose myriad sweat-ducts are constantly being flushed by the hardness of his work ; but whose skin surface, possibly, is soiled with the various grimy particles with which his labour has brought him in contact. A clean skin is an impossibility without perspiration ; and if the necessary perspiration be not brought about by the ordinary business of life, it is advisable to encourage it by artificial means. Hence bathing is more necessary to the man of sedentary occupation than to one who knows the daily luxury of physical exertion. For the purposes of cleansing, the bath should be warm, the skin should be well soaped, and a subsequent thorough friction with a rough towel should be indulged in. This process has the effect of removing the outer layer of the cuticle, of softening the secretion lying in the mouths of the sweat-ducts, and by the action of the heat dilating the blood-vessels of the skin and encouraging perspiration. Its utility and its comfort are so well known that there is no necessity for making any formal remarks thereupon.

Perhaps there is no better form of exercise than that to be found in a good swimming bath, always provided that an open river or the sea is not at hand. The swimmer exercises every muscle in his body ; and, if swimming be vigorously kept up, there is nothing which more speedily induces fatigue. For an athlete in training a daily swim ought to be a part of his course of exercise.

We wish there were more swimming baths in London than there are. Such as exist are all overcrowded in the summer, and in many of them the ventilation is not of the best. To take violent exercise in a close, badly-ventilated room must be wrong, and we would advise no one to patronise a bath which smells in the least degree stuffy. Swimming should be practised not more than once a day, and about midway between two meals. The bather, at the commencement of his course, should not remain more than five minutes in the water; and if his bath be not followed by a healthy glow, he will recognise that even that is too much for him. The time of the bath may be gradually extended.

The cold bath in the morning is a luxury of which most of us know the value. It cleanses, stimulates, and braces; and, if used in moderation, conduces to health. A word of caution is necessary to those who use their "morning tub" too heroically. The best criterion as to the advisability of continuing its use is the readiness and completeness of the reaction; and, if there is any feeling of chilliness, languor, or want of appetite, with an inability to eat breakfast, it is as well so ask whether, possibly, the cold bath had better be moderated. Persons who suffer from rheumatic pains, or sciatica, or neuralgia, ought also to be careful about continuing a practice which may be too severe for them. It is always easy to

add a small quantity of warm water to the bath. There can be no doubt that a daily bath is absolutely necessary for the health of children who are tender-skinned and too young to attend to their personal cleanliness.

There are certain diseases in which cold bathing is of acknowledged service :—

Foremost among these is *fever*, and it is not too much to say that many lives have been saved by the timely use of the cold bath. The use of it, however, requires great judgment and knowledge, and it is not applicable to every case, and is not without danger. In this country its use is restricted almost entirely to those cases in which the fever runs a very severe course, in which the bodily temperature rises above 105° Fahr., and the patient attains what is technically known as a condition of hyperpyrexia. The use of cold baths in fevers has been known from time immemorial, although it has only attracted the attention of modern physicians during the last ten or fifteen years. The usual method of employing this treatment is to immerse the patient in a bath of about 90° Fahr., or 95° Fahr., and by means of removal of hot water and its renewal by cold, gradually, in about 20 minutes, to reduce the temperature to 60° Fahr. In this way the temperature of the patient may be reduced as much as four or five degrees, and his sufferings are usually very much diminished. Cold bathing cannot be said to *cure*

the fever, but it prevents some of its worst results, and may enable the patient to pass through a trying ordeal unscathed. All forms of fever may, occasionally, be treated with cold baths ; but this method of treatment in no case shortens the course of the fever.

Cold bathing is of considerable use in some nervous affections, such as hysteria, St. Vitus's dance, and spasmodic croup. These affections often, if not always, depend upon a depressed condition of health, and a cold bath of short duration (before a fire in winter), and followed by a brisk rubbing, is a very efficient means for their relief.

Rickets is benefited by cold bathing ; but for the relief of this and other conditions of weakness the greatest moderation must be observed.

Cold water is sometimes of use when locally applied, and seems to act as a wholesome stimulant to parts which have become stiffened by want of use, such as strained and sprained joints. In some skin diseases benefit will be derived by the use of cold water. This is particularly the case in itching of the skin or *Prurigo*, and *Acne*.

Warm baths are far more generally useful in diseases than cold baths. For the removal of the thickenings around joints, which have been caused by gout or rheumatism or "rheumatic gout," bathing in tepid or hot water is justly considered as a powerful means of alleviation,

and as a valuable accessory to treatment by diet and regimen. The hot water of Bath and the tepid water of Buxton have long enjoyed a great reputation for gout and rheumatic gout, and there are many baths on the Continent, which have a reputation, equally high, in the treatment of these affections, such as *Teplitz*, *Gastein*, *Wiesbaden*, and *Wildbad*. The treatment of gout by bathing is usually aided by the internal administration of mineral water, but into this question we are unable to enter, notwithstanding its great importance.

For exudations round joints, which have arisen from causes other than gout and rheumatism, warm bathing is of very great service, as well as in relieving the stiffness and thickenings which sometimes occur as the result of severe wounds.

For *paralysis* warm bathing is often of great use, provided the cause of the paralysis be a removable one. Formerly, the principal method of treating cases of lead paralysis occurring in the cider counties of the West of England, was the sending of the patient to the warm springs at Bath, and the results were generally very good. There are many forms of paralysis which could not be benefited by treatment with hot water or anything else; but it is impossible, in an elementary treatise, to enter into a question requiring a high degree of medical knowledge for its proper appreciation.

For neuralgia, sciatica, lumbago, and many forms of muscular rheumatism, hot bathing may be employed with advantage.

For Bright's disease of the kidneys, warm baths, vapour baths, and Turkish baths, are all employed with benefit.

An occasional Turkish or hot bath is a very great aid to the well-being of dwellers in cities who get an insufficiency of air and exercise, since it produces an activity of the skin which can only be brought about by such means or by violent exertion.

A common cold may sometimes be cured by means of a Turkish bath. To bring about this result, however, the treatment must be applied in the very earliest stages of the disease, when the slight tension in the head, or a trifling feeling of chilliness, are warning the patient of his coming trouble, and before the running of the eyes and nose has thoroughly set in. A Turkish bath in this very earliest stage of a cold will sometimes cut the disease short, but such a result is, unfortunately, by no means invariable.

Warm baths, as aiding the action of the skin, have been regarded as of some value, when combined with proper diet and regimen, in the treatment of diabetes.

In diseases of the skin warm bathing is occasionally of service. For *psoriasis* a soaking in hot water has the effect of removing the scales from the body, but it has

probably no real curative influence on the disease. In acne, chloasma, and diseases which are fostered by a want of attention to cleanliness, warm bathing is of great service, especially when aided by a liberal supply of soap and the rigorous use of the flesh-brush and rough towel.

Although we are all ready, perhaps too ready, to recognise the great value of water applied externally, we are not always so quick at recognising the evil effects of an excessive use of baths.

Professor Hebra, of Vienna, one of the greatest authorities living on the diseases of the skin, speaks in very decided tones of the occasional harmful action which water exerts upon the skin. "It is," he says, "almost universally believed that the frequent use of vapour and shower baths, frequent bathing in warm or cold water, frequent washing and scrubbing, are healthful operations which can never do any harm.

"Against this opinion I must enter my decided protest. On the one hand, we know that there are millions of human beings who have never bathed in warm or cold water all their lives long, who, at the utmost, give their hands and face a superficial rinse once a week, and nevertheless enjoy up to old age a state of health which may well be envied. On the other hand, none can prove by statistics that the frequent use of the various kinds of

baths protect people from sickness, or that washing in cold water strengthens the body against catarrh and rheumatism and catching cold. So long as bathings are accompanied by a feeling of comfort, and are not followed by any eruptions on the skin, they may, no doubt, be allowed as a pastime, an amusement, an aquatic sport ; but whenever the skin thus repeatedly irritated begins to react—as soon as itching, more or less severe, follows ; as soon as persistent redness or wheals, or pimples or watery heads make their appearance—it is high time to leave off bathing and washing if we do not wish to produce diseases of the skin, which often take months and years before they disappear, and give the patient unspeakable misery.”

Simple baths do not irritate the skin so much as when combined with shampooing and wet packing and shower-baths, or when a vapour bath is made more efficient by friction and by the various manipulations of the Turkish or Russian bath. The result of such attacks upon the skin are seldom long to wait for. Sooner or later a continual redness appears, followed by burning or itching ; then come pimples, boils, and pustules ; and though in past times these eruptions were regarded as critical and beneficial we must now look on them in their true light, as simply the injurious results of the action of water.

Hebra has used the warm bath with success in alle-

of causing general stimulation and excitement. As to the cooling effect of these varieties of baths, Dr. Jacob has noted that a water bath of an hour's duration, and of a temperature of 91.4° , lowers the bodily temperature of a healthy man about $.9^{\circ}$; the mud bath of same duration and temperature 1.5° ; the salt bath 2° , and the carbonic acid bath about 2.6° .

Sulphur baths in former times enjoyed a very great reputation in the treatment of skin diseases, gout, rheumatism, and the effects of metallic poisons, especially lead and mercury. There is, however, probably nothing peculiarly beneficial in the sulphur, and the good effect of these baths is due more to the heat of the water than to anything else. Many of the sulphur springs may rightly be regarded as salt waters also, and they have a great power of skin-stimulation, a power which adds immensely to their therapeutic efficacy. The bather in sulphur water is constantly inhaling the vapour of sulphuretted hydrogen, and this fact may have not a little to do with the good effects of the water. A course of bathing at a sulphur spring is generally combined with the internal administration of the water, and it is consequently a very difficult problem to determine whether the internal or external administration of the water has the greater effect in producing the desired cure.

Steel baths, or baths containing iron, have fallen almost

entirely into disuse, and any effect which was formerly attributed to the chalybeate water is now with more probability ascribed to the water and its temperature. The change in this respect is scarcely greater than that which has taken place at Carlsbad, where purgative waters, formerly used chiefly for bathing, are now almost exclusively employed for drinking.

The author of the 'Bubbles from the Brunnens' thus describes his feelings while taking a steel bath at Langen Schwalbach, some forty years ago :—

"As soon as the patient was ready to enter his bath, the first thing which crossed his naked mind, as he stood shivering on the brink, was a disinclination to dip even his foot into a mixture which looked about as thick as a horse-pond, and about the colour of mulligatawny soup. However, having come as far as Langen Schwalbach, there was nothing to say but '*en avant*,' and so, descending the steps, I got into stuff so deeply coloured with the red oxide of iron that the body, when a couple of inches below the surface, was invisible. The temperature of the water felt neither hot nor cold, but I was no sooner immersed in it than I felt that it was evidently of a strengthening, bracing nature, and I could almost have fancied myself with a set of hides in a tan-pit. The half-hour which every day I was sentenced to spend in this red decoction, was by far the longest in the twenty-

four hours, and I was always very glad when my chronometer, which I regularly hung on a nail before my eyes, pointed permission to me to extricate myself from the mess. While the body was floating, hardly knowing whether to sink or swim, I found it was very difficult for the mind to enjoy any sort of recreation, or to reflect for two minutes on any one subject; and as, half shivering, I lay watching the minute-hand of my dial, it appeared the slowest traveller in existence."

In the delightful book from which the above quotation is taken, no mention is made of the disease, if any, for the relief of which the author underwent the unpleasant ordeal of the iron bath. The reader, however, will have no difficulty in surmising that the good he derived at Langen Schwalbach was due more to the change of air and scene and occupation than to the disagreeable bathing process to which he submitted daily. There is, or has been, a great deal of superstition in medicine, and the public have, or used to have, a surprising amount of faith in nasty medicines. In old dispensaries will be found the records of prescriptions into the composition of which there entered hideous and nameless abominations, and we are very much inclined to think that the lingering belief in steel baths, sulphur baths, and mud baths is but the remnant of a dying faith in nasty prescriptions, and the necessity of doing penance.

CHAPTER V.

A VISIT TO A BATH.

WHEN the doctor's fiat goes forth that his patient is to visit this or that bath for the benefit of his health, far more is implied in the injunction than the mere use of water, whether mineral or indifferent, hot or cold. It means that the sufferer is to leave his usual place of abode, and the climate which may perhaps have been instrumental in working him ill ; to forsake the numerous causes of mental worry and bodily fatigue which may be connected with his occupation or his family cares ; to bid adieu for a while to the cook—good, bad, or indifferent—who perhaps has tickled his palate to the ruin of his stomach, and the cellar which has daily furnished those wines which, gravitating to the toes, have necessitated the big boot and the stout staff ; to turn his back for a season on all that is implied in the words “good society,” and exchange all these for something else. Whether that exchange will be beneficial or otherwise will depend upon the knowledge of the patient possessed by the adviser—knowledge, not only of his constitution and his ailments, but of his pocket and his inclinations. The man of cultured mind, like Sir Francis Head, whose diary of life at Langen Schwalbach forms so charming a

volume, who is able to find amusement in the contemplation of human nature, or of natural phenomena, who

“Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything ;”

whose resources are within himself, will find his recreation everywhere, and provided the place to which he is sent be wholesome, he will get all the benefits which are derivable from change of scene and air. It would be cruel and useless, however, to send the votary of pleasure to a resort where art provides nothing for the amusement of the guests, and equally useless to condemn a man accustomed to a simple country life to mingle all day long in a fashionable crowd, intent on artificial joys. There is no doubt that on the Continent the arrangements for the comfort and amusement of guests visiting a bath are more perfect than they are in this country ; and the invalid who crosses the “ silver streak ” which separates us from the rest of Europe will find a greater difficulty in continuing in that groove of existence which, mayhap, has been prejudicial to him. On the other hand it must not be forgotten that to many persons foreign travel is exceedingly distasteful. There are many who know no language but English, and whose prejudices are so in favour of English manners and customs that they cannot be induced to fall in with Continental habits. We remember

seeing a gentleman at a fashionable bath abroad, whither he had been sent for the relief of his gout, who was evidently most grievously bored by the process of cure. He associated with none, dined alone, and day after day partook, in a solitary corner of a restaurant, of a fried sole, a mutton chop, stilton cheese, and a pint of dry sherry.

A man who thus carries his own atmosphere with him, and who persistently goes against the stream, wrapping himself in insular prejudice, will find very little benefit in foreign travel or in change of scene.

There are few bathing places, either in this country or on the continent, where the drinking of water does not hold a position in the "cure" which patients are prepared to undergo, at least equal to the bathing. Drinking of mineral water and bathing go everywhere hand in hand, although at different spas the one or the other method of treatment will be found to preponderate. With the drinking of water we have, as we have before said, nothing, at present, to do ; but, although in theory it is easy enough to separate the effects of bathing from those of water drinking, it is found less easy to do so in practice.

What Epidaurus was in the palmy days of Greece when thousands flocked to seek health and recreation at its renowned temple of Æsculapius ; what Baiaë was to the luxurious Romans who came to its famous warm springs, impelled equally by fashion and disease ; what Bath was

when at the zenith of its popularity ; such is the Badstadt of the present time. The throng in the town in the height of the season (July and August) is very great, and the crowd of visitors is as fashionable as it is cosmopolitan. Here are German petty potentates, Russian princes, English nobles, and wealthy Americans, by scores ; and there can be no doubt that the charm of a fashionable watering-place like this is by many found in the fact that all men are, more or less, upon an equality where there is only one fountain from which they all must drink, and one source in which they all must bathe. The duke, whose pedigree reaches back to the Dark Ages, must equally wait his turn with the merchant whose wealth is of yesterday's creation ; and in waiting-rooms of bath-houses, at tables-d'hôte, and at the brink of healing fountains, blood which is of the bluest tint comes into very close contact with that which is of other shades.

The town of Badstadt is most charmingly situated upon an elevated plateau, some 600 or 700 feet above sea-level, and in the midst of delightful scenery, which is to be found among the mountains which surround the town on every side but one. The mountains are clothed to their summits with pine, and these pine woods are amongst the most favoured places to which the "cure guests" of Badstadt resort. In the depths of the pine forest there is always, even in the hottest day, a refresh

ing coolness and an invigorating aroma, and to wander here with a book, or a companion and some luncheon, is a most pleasant method of killing the sultry hours of noon. One day is pretty much like another at Badstadt, although here is just sufficient variety to obviate any feeling of irksomeness. What will the fashionable Londoner think when, at six o'clock in the morning, he finds that he can no longer sleep because every one in the hotel is already stirring? There is nothing for it but to go with the stream, to get up and dress oneself (in the nattiest of lounging coats if of the male sex, in the most bewitching of light summer costumes if of the female), and away with the rest of the world to drink the water at the Betsinda Quelle, the most fashionable spring in all Europe. It is not seven o'clock, we are nearly four hours earlier from our beds than is our wont, the fresh morning air is bracing and delightful, the sun has not yet dissipated the dew, and yet the whole world of Badstadt is alive. Here beneath the trees of the Cur-garten are some 2000 or 3000 fashionables, all sauntering and talking, so that the hum of conversation is audible at a great distance, and forms a not inharmonious obbligato to the music of the orchestra in the Kiosk which is hard by. Few prettier sights than this can be seen or imagined. The avenue of limes offers in either direction, a most attractive vista ; the sunlight comes glinting through the

fret-work of leaves upon the gravel, creating little dancing shadows and lighting up the many and varied colours of the ladies' costumes; the roses in the neighbouring flower-beds lend their bright colours to give the eye additional pleasure, while their aroma tickles yet another sense; and the ear is pleased by a performance, by an excellent band, of the best compositions of the best masters. The focus, as it were, of all this gaiety is the Betsinda Quelle, and most of the guests may be seen to advance to the edge of the health-giving fountain, which is enclosed in a sunken ornamental basin, and tender a glass for the prescribed dose of the water. The water contains a good deal of common salt and not much else, and is nearly as nasty as sea-water; but it is surprising to see how methodically and with how little fuss the *habités* get through their allotted portion. The physician probably said to this or that patient: "You are to drink two glasses of the Betsinda, and you are to walk for twenty minutes after each glass;" and one may see hundreds, who, watch in hand, carry out their directions to the letter. He who frequents the springs regularly will soon recognise that, morning after morning, the same people arrive at the same time, consume the ordained number of glasses and disappear. The majority of these, it must be confessed, do not appear to be very ill, although here and there may be seen some whose faces bear evidence of disease, whose

limbs are crippled with gout or rheumatism, and who accomplish the morning promenade with the aid of sticks or crutches, or, in place of walking, perform a cruise upon wheels in an invalid chair. Badstadt is above all things a pleasant place, and everything has been done that money can accomplish to charm the senses and make life agreeable. The notables of society are its chief patrons, and there can be no doubt that the majority of the visitors come here for the season, strange as it may seem, that they may meet the same persons that they have been meeting earlier in the year in the "Row," upon the lawn at Goodwood, or in the salons of Paris. "Good Society," by which term we mean those wealthy and noble individuals who prefer an artificial to a natural existence, annually makes itself ill by attending too assiduously to its duties. Having risen from its bed some eight hours later than the sun ; having dined largely every night on a mixture of all that is rich and unwholesome ; and having freely partaken with its meals of all manner of liquids other than water ; having danced night after night in rooms reeking of androsmia (which is polite Greek for the "smell of humanity"), and rendered stifling by wax lights or gas ; having retired to bed just before sunrise, and, in short, having shown an unaccountable dislike for the light of heaven, and an equally unaccountable preference for those wretched and poisonous substitutes

which our dark northern latitudes have rendered necessary, Society takes itself to Badstadt to try the experiment of undoing all the mischief which has been brought about by its own folly. The morning promenade is an integral and most important factor in the Badstadt cure ; and the potations of salt water have not only a cleansing and "alterative" effect, but they damp the appetite a little, and help to prevent Society from taking too much food. The Badstadt breakfasts are very simple repasts ; one cup of coffee and delicious bread, butter is not allowed except to a favoured few who can find some good excuse for being treated exceptionally ; eggs are a luxury which the local doctors regard with manifest dislike ; and as for the chops, devilled kidneys, fried bacon, bits of fish, cold grouse, dabs of marmalade, and other "necessaries," which Society takes at home, they are not to be thought of.

After the frugal repast of coffee and bread has been disposed of, a novel or the newspaper serves to wile away an hour or so, and then the all-important time for bathing is at hand. The baths are of all kinds here, and are made of mineral water or simple water, according to the fancy of the patient or the prescription of the "Bad-artzt" (as the local practitioners are called). Both before and after the bath the patient scrupulously observes the directions of Hippocrates, and is careful to keep both

body and mind in a state of complete rest, so that sufficient power may be left to thoroughly digest the mid-day meal, which the English call luncheon and the Germans dinner. With those who are wise this meal is as simple as it can be made, and consists of a portion of braised or stewed meat, vegetable, and some simple farinaceous pudding. As for wine, half a bottle of weak Rhenish or Moselle is all that is allowed; visitors being especially warned to avoid even the stronger of the Rhenish wines, such as Rüdesheimer or Steinberger, vintages, towards which those English who have well-filled pockets are very apt to gravitate. In the middle of the day the Germans habitually take their heartiest meal, and towards one o'clock a stream sets in the direction of the 'Adler' or the 'König Wilhelm,' where possibly the same sixty or eighty persons meet day after day at the table d'hôte. These repasts are often regulated by the advice of the local physicians, and one great advantage of patronising them lies in the fact that it is impossible to get viands which are at all difficult of digestion, or which are likely to disagree with the waters. After dinner comes an open-air concert beneath the trees, in the garden of the Cur-haus, and the process of digestion is allowed to complete itself in the fresh air, while the ears are tickled by the sound of first-rate music.

For those who wish to read, the salons of the Cur-haus

are always open, and every journal of note which is published in San Francisco or St. Petersburg, or any of the intermediate cities, is freely placed at the disposal of the guests. When we say freely placed we mean freely to those who pay the "Cure tax," a small sum which is levied from all who come to participate in the enjoyments which are provided by the Badstaders for their guests.

The afternoon is devoted to a drive or a leisurely walk to the neighbouring forest ; and at six o'clock the English return to dine ; and at seven or half-past seven the Germans come home to supper. The *cuisine* at the Cur-haus, being modelled on Parisian lines, attracts many of the guests who cannot submit to the Spartan *régime* of Badstadt in its entirety ; and there may be seen occupying the small tables on the terrace snug parties of three or four having just one of those very "little dinners" which have been the main cause of that indisposition which has made a "cure" necessary. The evenings are usually occupied by promenading in front of the Cur-haus, and occasionally a display of fireworks, or an illumination is provided. There is a theatre too, at which the best actors and singers appear during the season ; but these after-dinner amusements are mostly of short duration, and, as a rule, Badstadt retires to bed not later than ten o'clock.

Thus it will be seen that life at a bath is spent largely in the open air, that the amusements and the routine of each day are regulated mainly with a view to health, that the diet is restrained within the limits of prudence, and that "early to bed and early to rise" is a wise maxim, to which a rigid adherence is expected of all who come in quest of health to the baths and springs of Badstadt. It is not surprising that the Badstadt waters should be regarded as a panacea throughout the whole of Europe.

the economy. The model is a dynamic system of three equations, which can be written in matrix form as follows:

$$\begin{bmatrix} \dot{Y} \\ \dot{K} \\ \dot{L} \end{bmatrix} = \begin{bmatrix} 1 - \alpha - \beta \\ \alpha \\ \beta \end{bmatrix} \begin{bmatrix} Y \\ K \\ L \end{bmatrix} \quad (1)$$

where \dot{Y} , \dot{K} , and \dot{L} are the time derivatives of Y , K , and L , respectively. The matrix $\begin{bmatrix} 1 - \alpha - \beta \\ \alpha \\ \beta \end{bmatrix}$ is the Jacobian matrix of the system.

The system (1) is a linear system, and its solution can be found by using the method of undetermined coefficients. The solution is given by:

$$\begin{bmatrix} Y \\ K \\ L \end{bmatrix} = \begin{bmatrix} Y_0 \\ K_0 \\ L_0 \end{bmatrix} e^{\lambda t} \quad (2)$$

where Y_0 , K_0 , and L_0 are the initial values of Y , K , and L , respectively. The eigenvalue λ is given by:

$$\lambda = -\frac{\alpha + \beta}{1 - \alpha - \beta} \quad (3)$$

Since α and β are positive, the eigenvalue λ is negative, which implies that the system is stable.

The long-run equilibrium values of Y , K , and L are given by:

$$\begin{bmatrix} Y^* \\ K^* \\ L^* \end{bmatrix} = \begin{bmatrix} Y_0 \\ K_0 \\ L_0 \end{bmatrix} e^{\lambda t} \quad (4)$$

where Y^* , K^* , and L^* are the long-run equilibrium values of Y , K , and L , respectively.

The long-run equilibrium values of Y , K , and L are independent of the initial values of Y , K , and L .

The long-run equilibrium values of Y , K , and L are given by:

$$\begin{bmatrix} Y^* \\ K^* \\ L^* \end{bmatrix} = \begin{bmatrix} Y_0 \\ K_0 \\ L_0 \end{bmatrix} e^{\lambda t} \quad (5)$$

where Y_0 , K_0 , and L_0 are the initial values of Y , K , and L , respectively.

The long-run equilibrium values of Y , K , and L are independent of the initial values of Y , K , and L .

The long-run equilibrium values of Y , K , and L are given by:

$$\begin{bmatrix} Y^* \\ K^* \\ L^* \end{bmatrix} = \begin{bmatrix} Y_0 \\ K_0 \\ L_0 \end{bmatrix} e^{\lambda t} \quad (6)$$

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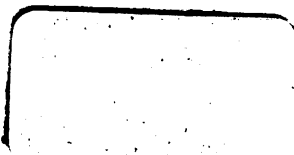
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